THE RELATIVE POTENCY OF CLASSROOM DISTRACTERS ON STUDENT CONCENTRATION: *WE HAVE MET THE ENEMY AND HE IS US**

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ABSTRACT
There has been considerable discussion about the potential negative effects of various technologies on student concentration in the college classroom. In response, some instructors have banned the use of laptops, smart phones and other electronic devices during class sessions. Despite these concerns and responses, little empirical research exists on the relative potency of these and other types of classroom distractions. Our objective was to develop a model for examining classroom distraction and to investigate student perceptions of the degree of distraction produced by thirty-six externally produced and twenty-one self-produced classroom situations. The results of this pilot-study survey indicated that difficulty in understanding the instructor was the most potent distracter to student concentration. Other students talking in class was also perceived to be very distracting. Clothing worn by the student and other students was among the least distracting. Overall, external distracters (i.e., those produced by other people and things) were significantly more potent than distractions produced by the students themselves. We conclude by discussing study limitations, extending this research beyond the pilot study and the pedagogical implications of the preliminary findings.

INTRODUCTION
Teaching in today's college classroom may be more difficult than ever. Professors commiserate about student skill deficits in reading, writing, and cognition. Technology increasingly invades our classrooms. Initial changes, such as PowerPoint, focused on enhancing our teaching techniques. But technology changes shifted from the instructor to the students. Today we attempt to cope with our students' technological toys, that is, their laptops, netbooks, cell phones, smart phones. Add to these electronic gnats the usual sneezing, whispered conversations, and napping, and the teaching-learning process is compromised.

We are bombarded by multitudes of external and internal stimuli every day: water running, a clock ticking, a conversation, a TV in the background. Hygge (2003) argued that "both acute and chronic noise exposure" affected long-term recall in children and also the central cognitive processes involved in reading and language comprehension skills. Students, particularly college students, are probably exposed to more types of stimuli than any other group, given their penchant for social interchange and group activities. But have they also learned how to filter them effectively?

The literature on college classroom distractions centers mostly on laptops both as instructional tools and as distracters. Much of the research (Fried, 2008; Lohnes and Kinzer, 2007) examines the misuse of technology (e.g., cell phones, MP3 players) during class time to the detriment of the student and those around him, in effect creating a "digital underlife" (Mueller, 2009). Actual distractions of student-to-student interactions are also a major factor (Young, 2003). Most research reflects the instructor's perspective (Bujega, 2006; Seidman, 2005). In contrast, our objective was to determine, from a student's perspective, the relative degree or intensity of distraction due to various external and self-generated situations and behaviors in the classroom. Understanding the relative potency of these distractions may help us ensure classroom environments that optimize the potential for learning.

Instructional technology and technological toys in the classroom affect student concentration. Campbell (2006) and Gilroy (2003) revealed the negative impact of mobile phones on both faculty and students. Shelton, Elliott, Eaves, and Exner (2009) conducted four experiments that demonstrated further detrimental effects of a ringing cell phone on cognitive performance. Research in a law school (Yamamoto, 2007) found that improper laptop use interfered with learning and memory. Further evidence that in-class use of laptops involving multitasking was distracting and negatively affected several measures of student learning was obtained by (Fried, 2008; Kinzie, Whitaker & Hofer, 2005).

Technology and its applications are not the only classroom distracters. Sneezing, talking between students, personal hygiene, and the classroom environment, for example, can all be distracters. Seidman (2005) surveyed "disruptive student behavior in college classrooms" and found that these behaviors contributed to unsatisfactory learning environments that could be linked to students leaving a university early. Boice (1996) examined various behaviors, such as being unprepared for class and disruptively arriving late for or leaving early from class.

Our study merged these two lines of research, technology and behaviors. Using our model of factors in classroom environments, we investigated student perceptions of the intensity of the distraction produced by each of thirty-six externally produced and twenty-one self-produced classroom behaviors and situations.

MODEL

The Figure 1 establishes our foundation for the study of classroom learning. We propose that a number of classroom factors in addition to course content, instructor ability and student characteristics affect learning outcomes. For this study, we are focusing on the center of the figure, the types of classroom distractions and a few student characteristics. Distracters are placed into two categories, those produced by the student and those generated by others.

HYPOTHESES

The literature on classroom distractions provides little guidance for the development of hypotheses on the relative potency of different types of classroom distractions. Therefore, our study is primarily

exploratory. However, the literature on the psychology of memory and attention cited above does provide a foundation for the development of the following general hypotheses.

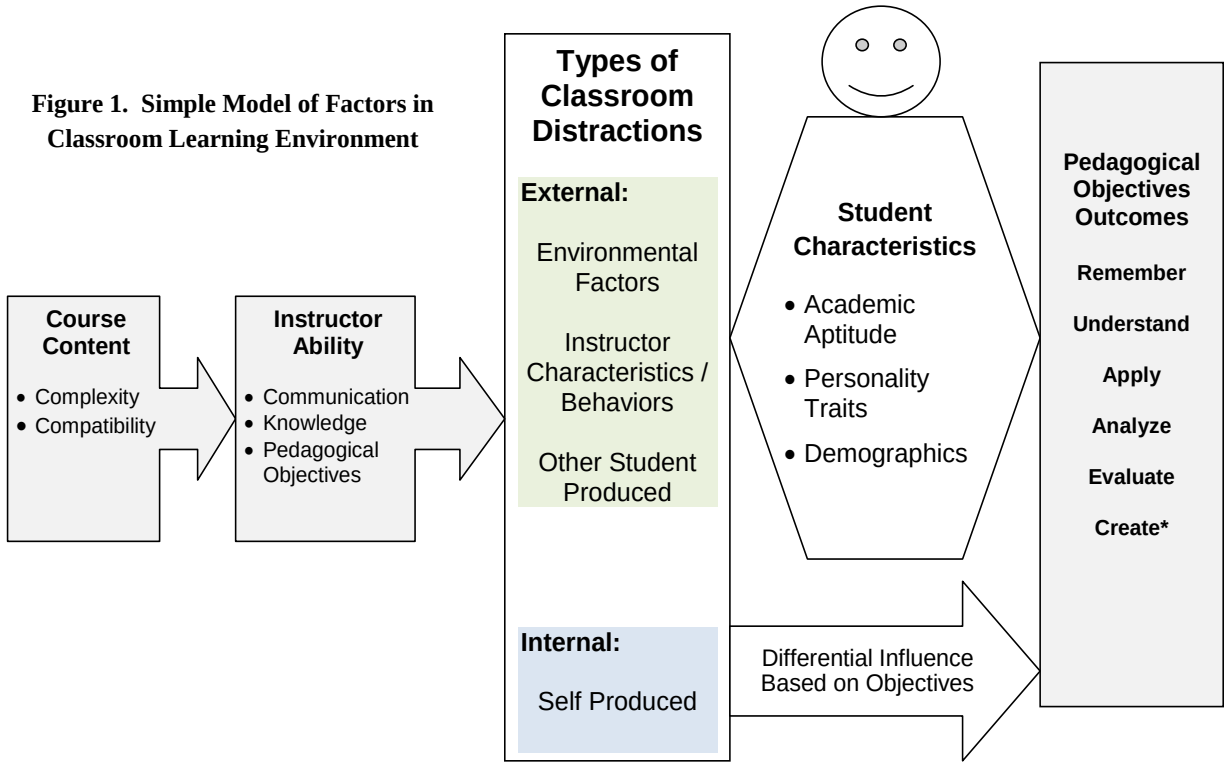
H1: Overall, external distracters will have more potency than distracters that are self-produced by the student.

H2: Internal distracters that are associated with the physiological state of the student (e.g., sleepiness, illness) will be more potent than distracters that are more passive or routine (e.g., clothing, drinking.)

H3: External distracters that disrupt the flow of information from instructor to student (e.g., other students talking in class, other noises) will be more potent than distracters that do not directly disrupt this flow of information (e.g., clothing of other students, silent activities of other students.)

H4: Different groups of students (e.g., gender, academic level, academic performance) are likely to have different patterns of attention and perception in the classroom, therefore they are likely to be differentially affected by external and internal distracters.

Figure 1. Simple Model of Factors in Classroom Learning Environment



METHOD

Two anonymous online surveys (pilot survey and primary survey) were used to collect students' ratings regarding the extent to which a set of potential classroom distractions affects them. (No revisions to the pilot survey instrument were required, therefore we were able to combine the data from the two studies for the analyses presented in the following section.) The sample included students from a private and a public university in Connecticut. Students indicated on a seven-point scale (1- not distracting at all; 7- extremely distracting) how distracting each of 36 external and 21 self-produced situations were on their ability to concentrate during a class lecture or discussion. The total sample size for the two studies was 169. The sample size of the pilot study was 72 and the primary study sample size was 97. Demographic and grouping data were collected only in the primary study.

FINDINGS

Test-Retest Reliability To examine the reliability of the survey instrument, the findings of two studies with different samples were compared. The correlation between the mean distraction scores on the two studies was r=.96, (p<.001, N1= 72, N2=97) indicating a high level of instrument reliability.

Relative item potencies The findings revealed substantial differences in the perceptions of the distracters in the classroom. Tables 1 and 2 present the sorted means and standard errors of the external and internal (self-produced distracters.) The ANOVA on the external distracters was significant at the P<.001 (Pillai's Trace =.87; F=25.56, df=35/134). The ANOVA on the internal distracters was also significant at the P<.001 (Pillai's Trace =.84; F=39.06, df=20/149). Generally, mean differences of 0.80 or greater in Table 1 and in Table 2 were statistically significant at the 0.05 level using the Bonferroni adjustment for multiple comparisons. Students rated an instructor who is difficult to understand as the most potent external distraction, more so than all the other external and internal distracters. How other students looked or dressed produced the lowest level of distraction.

H1: This hypothesis was partially supported. The top four distracters in the study were external:

- Instructor that is difficult to understand
- Students talking with others in class
- Temperature (too hot/cold)
- Ringing phones & pagers

However, the overall mean of the external distracters (3.75) was not statistically significant from the mean of the internal distracters (3.84).

H2: This hypothesis was supported. Internal distracters that were associated with the physiological state of the student (e.g., sleepiness, illness) were found to be significantly more potent than distracters that were more passive or routine (e.g., clothing, drinking.)

H3: This hypothesis was supported. External distracters that disrupt the flow of information from instructor to student (e.g., other students talking in class, other noises) were found to be significantly more potent than distracters that do not directly disrupt this flow of information (e.g., clothing of other students, silent activities of other students.)

H4: Different groups of students (e.g., gender, academic level, academic performance) were differentially affected by external and internal distracters as summarized below.

Gender Women (N=48) were more likely to report higher levels of distraction overall relative to men (N=33). There was not a significant gender by distracter interaction.

Academic Level A comparison of graduate (N=22) and undergraduate students (N=59)indicated an interaction on the distracters. The graduate students were significantly <u>less</u> distracted than the undergraduates in the following situations:

Temperature (too hot/cold)
Ambient noise (e.g., AC noises, road noises, etc.)
Especially attractive students

The graduate students were significantly more distracted than the undergraduates in the following situations:

Other student illness symptoms (coughing, sneezing, sniffling, etc.)
Other students using video games
Other students sleeping
Other students doing work for other courses
Playing video games him/her self
Doing work for other courses

Academic Performance A stepwise multiple regression was computed to determine the relationship between GPA and the distracters. The R value was 0.51, N=81, F=12.05; P<.001. Two distracters were included in the final multiple regression model. The higher the student's GPA, the more distracting it was for them to be in a class where other students were sleeping. However, the students with the higher GPAs were less distracted by other students playing paper and pencil games, doodling, etc.

Table 1. External Distracters	Mean	SEM
Instructor that is difficult to understand	5.81	0.12
Students talking with others in class	5.29	0.12
Temperature (too hot/cold)	5.15	0.12
Ringing phones & pagers	5.02	0.13
Poor personal hygiene of other students (odors, looking dirty, etc.)	4.98	0.12
Classroom odors	4.89	0.13
Instructor spitting while talking	4.82	0.13
Students asking irrelevant questions or making irrelevant comments	4.59	0.14
Equipment problems (e.g., malfunctioning computers)	4.58	0.14
Students making repetitive movements(tapping fingers, pen clicking, etc.)	4.49	0.13
Student illness symptoms (coughing, sneezing, sniffling, etc.)	4.33	0.14
Instructor making repetitive or unusual speech sounds	4.28	0.13
Students using video games	4.09	0.16
Instructor exhibiting repetitive or unusual movements	4.04	0.13
Students using MP3 players	3.98	0.16
Lighting (glaring, too bright, etc.)	3.94	0.13
Instructor using repetitive words or phrases	3.86	0.13
Ambient noise (e.g., AC noises, road noises, etc.)	3.81	0.14
Furnishings (e.g., chairs, tables that are broken, dirty, etc.)	3.79	0.14
Students arriving late	3.63	0.15
Especially attractive students	3.47	0.15
Students leaving/returning to class	3.39	0.14
Students texting	3.38	0.15
Students leaving early	3.35	0.14
Provocative clothing worn by other students	3.30	0.14
Students using laptops for email, surfing	3.15	0.15
Students using smart phones	3.15	0.15
Students eating in class	2.98	0.13
Student response devices(Clickers)	2.94	0.14
Students playing paper and pencil games, doodling, etc.	2.76	0.14
Students sleeping	2.62	0.14
Students doing work for other courses	2.52	0.13
Clothing worn by other students(words, colors, styles, etc.)	2.30	0.11
Students drinking in class	2.18	0.12
Tattoos, piercings, hair color, bling, etc., of other students	2.11	0.11
Hats, hoods, etc. worn by other students	1.90	0.11

Table 2. Self Produced Distracters	Mean	SEM
Your illness symptoms (coughing, sneezing, sniffling, etc.)	4.98	0.13
Sleeping	4.96	0.16
Your phone / pager ringing	4.83	0.16
Playing video games	4.76	0.16
Talking with others in class	4.75	0.14
Using your MP3 player	4.63	0.17
Doing work for other courses	4.57	0.15
Using a laptop for checking your email, surfing, etc.	4.44	0.16
Poor personal hygiene (odors, looking dirty, etc.)	4.39	0.14
Texting during class	4.38	0.15
Using your smart phone	4.20	0.17
Arriving late to class	3.93	0.14
Leaving early	3.91	0.15
Playing paper and pencil games, doodling ,etc.	3.77	0.15
Leaving/returning to class	3.74	0.15
Student response devices(Clickers)	3.09	0.16
Eating in class	2.73	0.14
Wearing provocative clothing	2.52	0.13
Wearing clothing with unusual words, colors, styles, etc.	2.09	0.11
Drinking in class	2.06	0.13
Wearing hats, hoods, etc. to class	1.94	0.12

DISCUSSION

This study provides another example of Walt Kelly's quote "We have met the enemy and he is us." An instructor who is difficult to understand clearly surpassed all of the other 56 distracters evaluated by students in this study. As educators, we need to be aware of how we present course content and interact with students. Establishing clear learning objectives may help to increase the understandability of our lectures and class discussions. Further, we sometimes can control other distracters such as checking equipment before the start of class and reporting any problems with the room such as heating/air conditioning, lighting, or foul odors.

In contrast, things that many instructors find distracting are not perceived to be distracting to our students. For example, students who wear hats and hoods to class or have tattoos, piercings, hair coloring, and bling (i.e., showy, flamboyant jewelry and accessories), or sleeping during class are minimally distracting to other students. Students have apparently adapted to some behaviors of their fellow students, such as using the internet, texting and drinking in class. However, students can distract fellow classmates by talking during class, not turning off phones, and having poor hygiene. In fact, students talking with others in class, was the second most potent distracter.

Students distract themselves the most when they are sick or sleep during class. These impaired physiological states clearly are a detriment to maintaining attention in class. Students are also distracted when their phones ring, when they play video games and when they talk to others. These findings are not surprising. Using other technology and the student's own hygiene were also reported to be top distracters.

The findings on the group differences are less clear. While we found differences between the groups examined in this study, we think the sample may be too small to draw general conclusions.

FUTURE RESEARCH

Our future research will examine the other elements of our model. In particular, we are interested in the possible interaction of student learning styles and other student characteristics (e.g., demographics, personality, etc.) with the various distracters examined in our current study. Further, as mentioned above, the sample size limitations for the group analyses in the current study may have been too small to differentiate distracters.

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*Quote from Walt Kelly